

# SUPPORTING FRAME STRUCTURE FOR TENSION-TYPE SHADOW MASK OF COLOR CRT

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

The present invention relates to a supporting frame structure for a tension-type shadow mask of a color CRT and particularly, to supporting frame structure for a tension-type shadow mask of a color CRT, wherein the curvature of the supporting frame for a tension-type shadow mask supporting frame for a color CRT having upper and lower tensions in a form of a single curvature, changes to have a form of a poly-nomial after compression is added.

### 2. Description of the Background Art

Figure 1 is a sectional view showing the conventional color CRT.

A front surface glass called as a panel 1, and a rear surface glass called as a funnel 2, are combined together. Inside the glasses, there are a fluorescent screen 4, an electron gun (not shown) which is a source of the electron beam 6 for hitting the fluorescent screen 4, a shadow mask 3 for selecting color to radiating a predetermined fluorescent material, and a frame 7 for supporting the shadow mask 3.

In addition, a spring 8 for combining the frame 7 to the panel 1 and an inner shield 9 for shielding so that the color CRT is influenced less by the external geomagnetism during the operation of the color CRT are fixed on the frame 7 in

high-degree vacuum.

The operation of the color CRT is described that the electron beam 6 hits the fluorescent screen 4 formed on the inner surface of the panel 1 by a bipolar voltage applied to the color CRT in the electron gun (not shown) built in the neck of the funnel 2. At this time, the electron beam 6 is deflected toward the upper, lower, left and right directions by a deflection yoke 5 before reaching the fluorescent screen 4, thus to form a screen.

Also, the frame 7 has a magnet with 2, 4 and 6 poles for adjusting the orbit of the electron beam 6 so that the electron beam 6 hits a certain fluorescent material pixel in the fluorescent screen 4 precisely.

The color CRT is under high-degree vacuum and accordingly breakage is easily occurred. Therefore, to prevent the breakage of the color CRT, the panel 1 is designed to have strength enough to endure atmospheric pressure. Also, the color CRT is provided with a reinforcing band 11 formed in the skirt portion of the panel 1, and accordingly, the color CRT is constructed to have a sufficient impact resistance by dispersing stress applied to the color CRT under high-degree vacuum.

Figures 2A and 2B are a perspective view showing a supporting frame structure for a shadow mask according to a conventional art and a structure of curvature of a main frame before compression on the main frame, respectively.

Figures 3A and 3B are a perspective view showing a supporting frame structure for a shadow mask according to a conventional art and a structure of curvature of a main frame after compression on the main frame, respectively.

As shown in Figure 2A, a shadow mask assembly for color CRT having upper and lower tensions comprises upper and lower main frames 11 for

supporting the shadow mask, and a sub frame 12 which functions as an elastic suspending member and to which elastic force is applied in case of assembling the shadow mask by compressing the main frame 11 for fixing and supporting the main frame 11.

5 As shown in Figure 2B, before compression in the main frame 11 by forming a single curvature when the main frame 11 is compressed in order to prevent the shadow mask wrapping, the curvature of the main frame 11 conventionally has the form of poly-nomial.

10 As shown in Figures 3A and 3B, the radius of curvature of the main frame 11 after the compression in the main frame 11 can be identically formed to have a single curvature in every position, by forming a radius of curvature at the center of the main frame 11 smaller than that of curvature in a peripheral portion on both sides of the main frame 11 before the compression on the main frame 11.

15 Namely, as shown in Figure 2B, when the size of a radius of curvature at the central portion in the main frame 11 is  $R1$  and the size of a radius of curvature at the peripheral portion in the main frame 11 is  $R2$ , the structure of a radius of curvature satisfies the relation  $R1 < R2$ .

20 Figure 4A, 4B and 4C are a schematic view and graphs showing compression load and displacement according to a conventional art, and Figure 5 is a detailed view showing a radius of curvature and curvature structure of a supporting frame structure for a shadow mask before and after frame compression according to according to conventional art.

25 As shown in Figures 4A, 4B and 5, compression load  $T$  is applied to the peripheral portions at the right and left sides more than 2 times harder than at the center when the main frame 11 is compressed and the shadow mask is

assembled.

However, at the peripheral portions of the main frame 11, there is a sub frame 12 to which elastic force is applied and accordingly, the compression displacement  $\delta$  is more than 2 times at a center portion of the main frame 11 than at the peripheral portion.

Accordingly, to form the after-compression radius of curvature of the main frame 11 as a single curvature, the size of the after-compression radius of curvature of the main frame 11 at the central portion smaller than that at the peripheral portion.

Namely, in case that the compression load at the center portion of the main frame 1 is T1, compression displacement at the center portion is  $\delta 1$ , the compression loads at the left and right peripheral portions of the main frame 11 are T2 and compression displacements at the right and left peripheral portions of the main frame are  $\delta 2$ , the relations  $T1 < T2$  and  $\delta 1 > \delta 2$  are satisfied.

Figure 6 is a perspective view showing a structure combined with a general damper wires according to a conventional art.

As shown in Figure 6, to improve howling characteristics generated by the vibration of a shadow mask at left and right peripheral portions, after compression and welding the shadow mask on a main frame 11, one or three damper wires 13 for reducing the vibration of the shadow mask 3 are attached to the shadow mask 3 in the horizontal direction (X direction) in the structure of the shadow mask assembly for a color CRT having upper and lower tensions.

The damper wires 13 are fixed to damper springs 14 having a certain tension and the damper springs are attached on side portions of the sub frame 12.

According to the howling characteristics, howling phenomenon is not

recognizable since the center portion of the shadow mask 3 vibrates in Z direction and a screen change on which fluorescent material spreads and a landing change are not distinguishable.

However, at left and right peripheral portions of the shadow mask 3, the change in landing causes the howling phenomenon even though the shadow mask 3 vibrates a little and accordingly, damper wires 13 are attached to reduce the vibration of the shadow mask 3.

Figure 7 is a schematic view showing elastic force of the conventional damper wire.

However, in a supporting frame structure for a conventional tension-type shadow mask of a color CRT, as shown in Figure 7, in case that the after-compression radius of curvature of the frame is formed in a structure of a single curvature, a problem of howling phenomenon occurs since compression force  $t_1$  on the shadow mask 3 are stronger at the center portion than  $t_2$  at the peripheral portions of the shadow mask 3. Also, in case of increasing the tension of the damper wires to improve the howling characteristics, the damper wires are easily broken because the thickness of the damper wires is very thin as  $20 \sim 30 \mu m$ .

## SUMMARY OF THE INVENTION

Therefore, an object of the present invention is to provide a supporting frame structure for a tension-type shadow mask of a color CRT which can improve howling characteristics by compressing a main frame by applying a curvature structure of a supporting frame structure for a shadow mask of a color CRT having upper and lower tensions as a single curvature and then increasing contact force

by damper wire so that the curvature structure of the main frame is in the form of poly-nomial to solve the above problem and, which can reduce manufacturing cost of a supporting frame structure for a tension-type shadow mask.

To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein, there is provided a supporting frame structure for a tension-type shadow mask of a color CRT which includes a pair of main frames having a supporting part for supporting a shadow mask, respectively; and a pair of sub frames combined with the main frames for applying elastic force to the shadow mask; wherein the curvature structure of each one of the supporting parts in the main frames after the elastic force is removed satisfies the equation  $\Delta R / R = 0.95 \sim 1.05$ , where R is a radius of curvature obtained by connecting a center of each one of the supporting parts in the main frames and both ends of each one of the supporting parts in the main frames, and  $\Delta R$  is a radius of curvature obtained by connecting three arbitrary positions of each one of the supporting parts in the main frames.

Also, it is desirable that a curvature of each one of the supporting parts in the main frames has a radius of poly-nomial on condition that elastic force is applied to the shadow mask.

The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

5 In the drawings:

Figure 1 is a sectional view showing a conventional color CRT;

Figures 2A and 2B are a perspective view showing a supporting frame structure for a shadow mask according to a conventional art and a structure of curvature of a main frame before compression on the main frame, respectively;

10 Figures 3A and 3B are a supporting frame structure for a shadow mask according to a conventional art and a structure of curvature of a main frame after compression on the main frame, respectively;

15 Figure 4A, 4B and 4C are a schematic view and graphs showing compression load and displacement of a supporting frame structure for a shadow mask according to a conventional art;

Figure 5 is a detailed view showing a radius of curvature and curvature structure of a supporting frame structure for a shadow mask before and after frame compression according to a conventional art;

20 Figure 6 is a perspective view showing a structure combined with a general damper wires;

Figure 7 is a schematic view showing elastic force of the conventional damper wire;

25 Figures 8A and 8B are a perspective view showing a supporting frame structure for a shadow mask and a structure of a curvature before compression on a main frame in accordance with the present invention;

Figures 9A and 9B are a perspective view showing a supporting frame structure for a shadow mask and a structure of a curvature describing effect of compression force of damper wire in accordance with the present invention.

## 5 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

10 Figures 8A and 8B are a perspective view showing a supporting frame structure for a shadow mask and a structure of a curvature before compression on a main frame in accordance with the present invention.

15 Figures 9A and 9B are a perspective view showing a supporting frame structure for a shadow mask and a structure of a curvature describing effect of compression force of damper wire in accordance with the present invention.

20 A frame 20 is comprised of a pair of main frames 21 for supporting a shadow mask 30, and a pair of sub frames 22 combined with the main frame 21 for applying elastic force to the shadow mask 20 supporting the main frame 21 and according to the shadow mask assembly for a color CRT having upper and lower tensions, the curvature varies before and after compression of the frame 20.

Namely, by the difference in the compression displacement of the center portion and peripheral portions of the main frame 21 in case of compressing the main frame 21, the heights of the center portion and peripheral portions of the main frame 20 change in Z direction.

25 Namely, as shown in Figure 9B, in case the displacement in Z axis at the



central portion of the main frame 21 is  $Z1$  and the displacement in Z axis at the peripheral portions of the main frame 21 is  $Z2$ , the height of the main frame 21 in Z direction varies satisfying the relation  $Z1 > Z2$ .

Therefore, since the size of the radius of the curvature of before and after compression and curvature structure change, when the shadow mask assembly is manufactured, it is necessary to strengthen the damper wire 23 at the peripheral portions of the main frame 21.

Therefore, to making a inflection point around the peripheral portions of the main frame 21 after compressing the main frame 21, the radius of curvature of the main frame 21 is formed in the structure of a single curvature identically according to the position of the main frame 21 and accordingly before the compression, the change of position in Z direction can be provided with a curvature inflection point through the relative difference of the height of the main frame 21.

At this time, the radius of curvature of the main frame 21 is a single radius of curvature in case tension applied to the shadow mask 3 is removed in the structure of the shadow mask assembly.

As shown in Figure 8B, the single radius of curvature means that the radius of curvature in every position of the main frame 21 is identical and the single radius of curvature in accordance with the present invention means that the  $R$  which is a representative single curvature obtained by connecting the center of the shadow mask supporting portion of the main frame 21 and both ends of the main frame and  $\Delta R$  which is a radius of curvature obtained by connecting three arbitrary positions in the main frame 21 and the curvature structure of the shadow mask supporting portion in the main frame 21 satisfies the equation:

$$\Delta R / R = 0.95 \sim 1.05$$

The ratio  $\Delta R / R$  includes a tolerance range for manufacturing the main  
5 frame 21 mechanically and, after compression, required dual curvature can be  
obtained.

Also, by forming the structure of the curvature of the main frame 21 as a  
single structure before compression, namely, by having the same radius of  
curvature in every position of the main frame 21, the structure of curvature of the  
10 main frame due to the difference of the compression displacement of the center  
portion and the left and right peripheral portions in case of compressing the frame  
and a inflection point of the curvature by the difference of the compression  
displacement in case of compressing the frame and welding the shadow mask.

As apparent from the above, according to the present invention, the  
15 diminishing function of the damper wire can be increased by increasing the  
contact force at the peripheral portion of the shadow mask thus to improve the  
howling phenomenon, and in case of manufacturing the main frame mechanically,  
the cost for manufacturing in a single curvature form is less than that for  
manufacturing processing in a poly-nomial form.

20 As the present invention may be embodied in several forms without  
departing from the spirit or essential characteristics thereof, it should also be  
understood that the above-described embodiments are not limited by any of the  
details of the foregoing description, unless otherwise specified, but rather should  
be construed broadly within its spirit and scope as defined in the appended claims,  
25 and therefore all changes and modifications that fall within the meets and bounds

of the claims, or equivalence of such meets and bounds are therefore intended to be embraced by the appended claims.